

CLAIMS

What is claimed is:

1. A small-scale positioning device comprising:
a fixed frame;
a platform, movably attached to the fixed frame via at least one lever; and
a floating actuator device, coupled between the at least one lever and the platform, that when activated generates a force on the platform and an equal but opposite force on the at least one lever, thereby controlling the position of the movable platform relative to the fixed frame.
2. The positioning device of Claim 1, wherein each of the at least one lever is coupled to the platform at a respective fulcrum.
3. The positioning device of Claim 2, wherein each of the at least one lever is further pivotably connected to the platform via a respective flexure, the flexure being separate from the fulcrum.
4. The positioning device of Claim 3, wherein the floating actuator device is of an automated type.
5. The positioning device of Claim 4, wherein the floating actuator device is a piezoelectric type.
6. The positioning device of Claim 5, wherein the piezoelectric actuator device includes an actuator formed from a relaxor material.
7. The positioning device of Claim 4, wherein the floating actuator device is of an electrostrictive type.

8. The positioning device of Claim 4, wherein the floating actuator device is of an electromagnetic type.

9. The positioning device of Claim 4, wherein the floating actuator device is of a hydraulic type.

10. The positioning device of Claim 4, wherein the floating actuator device is of a pneumatic type.

11. The positioning device of Claim 4, wherein the floating actuator device is of a magnetostrictive type.

12. The positioning device of Claim 3, wherein the floating actuator device is of a manual type.

13. The positioning device of Claim 12, wherein the floating actuator device includes a fine adjustment screw.

14. The positioning device of Claim 12, wherein the floating actuator device includes a micrometer.

15. The positioning device of Claim 3, wherein the at least one lever includes a pair of levers.

16. The positioning device of Claim 15, wherein the pair of levers are arranged symmetrically to one another.

17. The positioning device of Claim 15, wherein the pair of levers are arranged slightly asymmetrically to one another to achieve a yaw or pitch motion.

18. The positioning device of Claim 3, further comprising at least one flexure, coupled between the platform and the fixed frame, that guides the motion of the platform.
19. The positioning device of Claim 18, wherein the at least one flexure includes a pair of symmetrical flexures.
20. The positioning device of Claim 3, wherein the platform may be repositioned in only a single degree of freedom of motion.
21. The positioning device of Claim 3, wherein the platform may be repositioned in at least two degrees of freedom of motion.
22. The positioning device of Claim 21, wherein the floating actuator device is a first floating actuator device, wherein the positioning device further comprises at least a second floating actuator device, and wherein the first floating actuator device repositions the platform in a first degree of motion and the second actuator device repositions the platform in a second degree of motion.
23. The positioning device of Claim 22, wherein the platform includes a first portion, coupled to the fixed frame by at least a first lever, and a second portion, coupled to the first portion by at least a second lever.
24. The positioning device of Claim 23, wherein the second floating actuator device moves the second portion of the platform relative to the first portion, and the first floating actuator device moves the platform relative to the fixed frame.
25. The positioning device of Claim 3, further comprising at least one control system that controls the operation of the floating actuator device.

26. The positioning device of Claim 25, wherein the at least one control system includes an open loop feedback controller.

27. The positioning device of Claim 25, wherein the at least one control system includes a closed loop feedback controller.

28. The positioning device of Claim 3, wherein the floating actuator device is coupled to at least a first lever at a lever interface, and wherein the fulcrum of the first lever lies generally between the lever interface and the flexure.

29. The positioning device of Claim 3, wherein the floating actuator device is coupled to at least a first lever at a lever interface, and wherein the lever interface lies generally between the fulcrum of the first lever and the flexure of the first lever.

30. The positioning device of Claim 3, wherein the at least one lever includes a cascaded lever arrangement.

31. The positioning device of Claim 30, wherein the cascaded lever arrangement includes a first lever, coupled between the platform and the fixed frame, and a second lever, coupled between the first lever and the platform, wherein the floating actuator device is coupled between the platform and the second lever, wherein activation of the actuator device causes the second lever to rotate about a first fulcrum, thereby applying a force to the first lever, and wherein the application of the force to the first lever causes the first lever to rotate about a second fulcrum, thereby controlling the position of the movable platform relative to the fixed frame.

32. A method of positioning a platform relative to a fixed frame in a small-scale positioning device, comprising:

providing a small-scale positioning device having a fixed frame, a platform that is movably attached to the fixed frame via at least one lever, and a floating actuator device, coupled between the at least one lever and the platform;

activating the floating actuator device; and

upon activating the floating actuator device, applying a force on the platform and an equal but opposite force on the at least one lever, thereby controlling the position of the movable platform relative to the fixed frame.

33. The method of Claim 32, wherein controlling the position of the movable platform relative to the fixed frame includes controlling motion of the movable platform relative to the fixed frame in one degree of freedom.

34. The method of Claim 33, wherein the floating actuator device is a first floating actuator device, the method further comprising:

providing a second floating actuator device;

activating the second floating actuator device; and

upon activating the second floating actuator device, controlling motion of at least a portion of the movable platform relative to the fixed frame in a second degree of freedom.

35. The method of Claim 33, wherein the step of providing a small-scale positioning device includes providing a small-scale positioning device having at least one flexure coupled between the platform and the fixed frame, the method further comprising:

guiding the motion of the platform in one degree of freedom via the at least one flexure.